Evidence about the potential role for Affirmative Action in higher education

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Abstract

In two recent cases involving the University of Michigan, the Supreme Court examined whether race should be allowed to play an explicit role in the admission decisions of schools. The primary argument in these court cases and others has been that racial diversity strengthens the quality of education offered to all students. Underlying this argument is the notion that educational benefits arise if interactions between students of different races improve preparation for life after college by, among other things, fostering mutual understanding and correcting misperceptions. Then, a fundamental condition necessary for the primary legal argument to be compelling is that the types of students who choose to enter college actually have incorrect beliefs about individuals from different races at the time of college entrance. In this paper we provide, to the best of our knowledge, the first direct evidence about this condition by taking advantage of unique new data that was collected specifically for this purpose.

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1 Introduction

In two recent cases involving the University of Michigan (Gratz v. Bollinger and Gruttinger v. Bollinger), the Supreme Court examined whether race should be allowed to play an explicit role in the admission decisions of schools. The primary argument in these court cases and others has been that racial diversity strengthens the quality of education offered to all students. For example, when describing the defense put forward by the University of Michigan in the Gratz v. Bollinger case, a Syllabus of The Supreme Court explains that "Respondents contended that the College of Literature, Science, and Arts has just such an interest in the educational benefits that result from having a racially and ethnically diverse student body and that its program is narrowly tailored to serve that purpose" (Gratz v. Bollinger, Syllabus, 2003).

Underlying the argument that diversity leads to educational benefits is the notion that universities educate students in a broad sense. Educational benefits arise if interactions between students of different races improve preparation for life after college by, among other things, fostering mutual understanding and correcting misperceptions. More directly, according to Jonathan Alger, who coordinated the University of Michigan's legal efforts in the two Supreme Court cases, the primary educational benefits of diversity do not arise because students experience different points of view, but, rather, because students may "discover just how much they have in common with their peers from other races" (Alger, 1997). Further, this is the view taken by the courts; when describing whether courts are sympathetic to the notion that the benefits of diversity arise because students from different races have different points of view, Alger says, "The courts frown on this (notion)...This is a group-based, stereotypical assumption, when the reality is the exactly the opposite" (Elgass, 1998).

In this paper we provide evidence about whether this primary legal argument is compelling. There do exist other possible rationales for affirmative action admission policies. Most notably, affirmative action could be viewed as a remedy for past discrimination. However, understanding the attractiveness of the primary legal argument is of fundamental im-

portance for groups on both sides of the affirmative action debate given the reality that the other rationales stand on less solid legal footing. For example, courts have made it difficult to defend affirmative action programs on the grounds of remedying past discrimination by focusing narrowly on an institution's ability to remedy discrimination that occurred at that institution (Alger, 1999). According to Baez (2003), "Many scholars believe that providing empirical evidence of the compelling need for diversity is the only hope for saving affirmative action."

Perhaps the most fundamental condition necessary for the primary legal argument to be compelling is that the types of students who choose to enter college actually have incorrect beliefs about individuals from different races at the time of college entrance. We do not have (scientific) evidence about whether this necessary condition is true. For example, for reasons that will be discussed throughout this paper, it does not seem prudent to assume that either formal or informal evidence of substantial racial sorting on college campuses should be viewed as Prima Facie evidence of incorrect beliefs. Further, one can think of factors that may tend to mitigate the extent to which incorrect beliefs are prevalent. Among these, it seems probable that the students who choose to enter college will typically have had a relatively wide range of experiences by the time of matriculation and will tend to be the most open-minded and informed of their age group. The objective of this paper is to provide, to the best of our knowledge, the first direct evidence about whether or not this necessary condition is true.[1] In essence, our approach involves providing evidence about two interrelated questions. First, "is it really the case that students from different races have a lot in common?" Second, "if students from different races do have a lot in common, is it the case that at least some students do not realize this at the time of college entrance?"

The other obvious condition necessary for the primary legal argument to be compelling is that diversity on a college campus is effective in changing students' beliefs about individuals from different races. It is this condition that has been the focus of other recent empirical

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[1]Although not the focus of their paper, the finding by Boisjoly et. al. (2006) that interactions with black roommates influence attitudes of white students towards minorities has some indirect bearing on this question.

work related to affirmative action admission policies. For example, related to the notion that interactions between individuals of different races are a necessary (but perhaps not sufficient) condition for changing beliefs, Marmaros and Sacerdote (2006) examine whether the quantity of email that a person exchanges with a student of a different race is influenced by whether the two students are assigned to the same freshman dorm. Likewise, Arcidiacono et. al. (2006) find that white students are more likely to "know two or more blacks well" if they attend schools that admit a higher percentage of black students. Boisjoly et. al. (2006) measure post-college attitudes directly and find that being assigned a black roommate causes a white student to become more empathetic towards minorities.

Thus, our work is distinct from other recent work because it examines an altogether different necessary condition. At the same time, this paper is strongly complementary to this other work because the condition examined in this paper and the condition examined in the other work together encompass the most obvious possible reasons for an immediate failure of the primary legal argument in support of affirmative action admission policies.

This paper provides evidence about whether students who enter college have incorrect beliefs about individuals from other races at the time of college entrance by taking advantage of unique longitudinal survey and administrative data that we have collected at Berea College. Located in central Kentucky, Berea College was founded in 1855 as the first interracial and co-educational college in the South and operates under a mission of "promoting understanding and kinship among all people." As some evidence of Berea's strong reputation for promoting understanding and harmony between individuals from different races, the daughter of South African Archbishop Desmond Tutu is a graduate of Berea and he served as Berea's 2005 graduation speaker. In addition, Berea College was recently named the 13th best college for African-American students in a DayStar ranking published in Black Enterprise magazine, with about half of the schools ranked above it being historically black colleges.[2] Given this history and reputation, it seems likely that individuals who select Berea

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[2]The criteria used to rank a school includes the academic and social environment for African-American students at the school. The Berea reputation as a good environment for black students is quite pervasive in the college choice literature. As another example, the Students' Guide to Colleges, which bases its rankings

would be relatively open to relationships with individuals from different races. This might suggest that if information problems exist between different races at Berea at the time of college entrance, then such problems might also exist elsewhere at the time of college entrance, although in the conclusion we discuss the need to be cautious when thinking about how the results here might generalize to other schools.

The particular belief we study is whether a student perceives that, on average, his friendship compatibility is higher with students of his race than it is with students of other races. While there are certainly other beliefs in which one might also be interested, this belief seemingly incorporates a variety of general views about individuals of other races. Perhaps most importantly, this belief relates closely to the legal argument that benefits of educational diversity arise, in large part, because students from different races learn that they have much in common.

We begin by taking an "actions speak larger than words" approach of trying to infer beliefs about interracial friendship compatibility from observed friendship choices, an approach that is possible because our data are unique among higher education sources in that they allow us to directly identify each person's friends.[3] The fundamental identification difficulty in this exercise is that friendship choices are influenced not only by beliefs about interracial friendship compatibility, but also by the process which governs how students meet potential friends. For example, a student who believes that, on average, he is equally compatible with students of his race and other races would still have a disproportionate number of friends of his race if he is involved in clubs, activities, social circles, or classes in which he meets a disproportionate number of students of his race. We are able to deal with this difficulty by

on the opinions of students, highlights the following quote from a student at Berea, "One thing that Berea does do extremely well is welcome in black students.... Black students really couldn't find a more open and accepting college than Berea with the exception of a historically black college like Morehouse or Howard."

[3]There is a literature in higher education whose primary goal is to to document the amount of interracial sorting using indirect approaches. Mayer and Puller (2006) use information obtained from Facebook.com. Marmaros and Sacerdote (2006) measure the quantity of email that is exchanged between pairs of students. These papers cannot provide any information about whether observed sorting is due to correct or incorrect perceptions. Most similar to the data used in this paper are the Addhealth data that identifies the friends of high school students (Fryer and Torelli (2006)).

taking advantage of the flexibility of our data collection efforts which allowed us to observe our first friendship choices at a time – immediately before classes began in the students' freshman year – when institutional details related to the orientation program and housing assignment process suggest that the process by which a person meets potential friends will, to a close approximation, be unconditionally random.[4]

Our friendship data indicate that very substantial racial sorting exists in friendships at the start of classes. As discussed in Subsection 3.1, although 15.8% of students at Berea are black, 69.6% of the best friends of black students and 66.8% of "all" friends of black students are black at the start of classes, while only 5.7% of the best friends of white students and 9.8% of "all" friends of white students are black at the start of classes. In order to provide guidance for thinking about the possible underlying reasons for this finding, in the remainder of Section 3 we appeal to a simple but flexible model of friendship-making under uncertainty. Under seemingly reasonable specifications, the model suggests that racial sorting occurs because some students believe they are, on average, more compatible with students of their own race than with students of different races.

As discussed earlier, in order to determine whether such a perception is incorrect, it is necessary to characterize the truth about interracial friendship compatibility. To do this, in Section 4 we take advantage of a unique natural experiment that arises because students at Berea are randomly (and unconditionally) assigned roommates in their freshman year. In essence, this experiment forces some students to learn about their friendship compatibility with an individual of a different race. Consistent with the claim that students of different races do have a lot in common, we find that white students and black students are very compatible as friends with white students being as likely to eventually become close friends with randomly assigned black roommates as they are to eventually become close friends with randomly assigned white roommates. Thus, if the racial sorting at the start of classes

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[4]Being able to observe friendship information at pre-chosen times for groups of particular interest is an important advantage of our survey collection efforts. For example, Marmaros and Sacerdote (2006) use a measure of social (email) interaction which is constructed by aggregating over a fourteen month period. Further, they observe this email measure for only 11% of Dartmouth's freshman class.

is indeed generated by beliefs that average friendship compatibility varies with the race of one's friends, then incorrect beliefs about individuals from other races do exist at the time of college entrance.

It would seem very difficult, using real-world data, to ever be entirely certain about this conclusion since one could always think of some alternative explanation for the observed sorting that could not be ruled out empirically. As such, given that virtually no direct information exists about the issue studied in this paper, it is perhaps best to view the approach here as an attempt to identify the most plausible explanation for the unique set of facts that we have uncovered. In this vein, the use of a simple theoretical model allows us, in Subsection 3.3, to discuss the specific assumptions that play a role in our interpretation of the observed sorting. Taking one step further, in Section 5 we discuss more substantial modifications to the model that might change the interpretation of the observed sorting. The goal of this discussion is to help the reader judge the plausibility of our conclusion. However, we are also able to bolster our belief that our conclusion is the most plausible by providing independent, direct evidence, that supplements our "actions speak louder than words" approach for characterizing beliefs at the time of entrance. Specifically, in Section 6 we develop a unique survey approach to eliciting beliefs which addresses the concern that, due to a potential tendency towards political correctness, systematic response errors would likely be prevalent if students were asked directly about their beliefs about interracial friendship compatibility. Consistent with our earlier conclusions, we find evidence that certain students enter college with a belief that they are, on average, more compatible with students of the same race than with students of other races.

We conclude the paper in Section 7 with a discussion of how the conclusions of this work should be shaped by the reality that we are studying one particular school.

2 The Berea Panel Study

The data come from the Berea Panel Study (BPS) which, as described in detail in Stinebrickner and Stinebrickner (2004, 2006, forthcoming), was initiated by Todd Stinebrickner and Ralph Stinebrickner with the goal of understanding a variety of decisions that students from low income families make after entering college. The BPS consists of two cohorts that entered Berea College in the fall of 2000 and 2001, respectively, and were surveyed between ten and twelve times each year while in school. Unique identifiers allow the survey data to be matched with student information from the school's administrative database.

Of particular importance for this paper, the BPS collected substantial information about friends and roommates four times each year while students were in school. In this paper, we utilize data from both cohorts in a couple of specific situations where it is particularly advantageous to do so for reasons related to sample size. However, for reasons related to identification discussed in the Introduction, we focus primarily on the second (2001) cohort because it was asked to provide friendship information on the baseline BPS survey which took place immediately before classes began in the freshman year. The participation rate for the baseline survey was approximately .90 for the 2001 cohort and Table 1 shows descriptive statistics for our sample of 375 students from this cohort. Approximately 43% of students at Berea are male and 15.8% of students are black. We note that, because the very large majority of non-black students are Caucasian, we combine all non-black students into a group that we refer to as "white" in the remainder of the paper. Consistent with the mission of the school to provide an education to students of "great promise but limited economic resources," students at Berea are all relatively poor and have an average family income of only approximately $25,000. The reality that students are quite homogenous in this respect is noteworthy for reasons discussed later.

3 Inferring Beliefs at the Time of Entrance

In this section we examine what observed friendship choices at the start of classes imply about beliefs about average interracial friendship compatibility. We first document the amount of racial sorting at the start of classes. We then view the sorting that is observed through the lens of a simple, but flexible, model of friendship-making under uncertainty and use this model to make inference about beliefs.

3.1 Descriptive Evidence About Sorting at the Time of Entrance

At the time that classes begin in the freshman year, we elicited friendship information for students in the 2001 cohort by using the following question on our baseline BPS survey:

Question A. Please list the names of the four people you currently consider your best friends at Berea College and provide information about where you met each of them. Please list in order with the person you would consider your best friend first.

	First Name	Last Name	Where I met this person Circle ONE
1.	_____	_____	Hometown At Berea College Other (specify) _____
2.	_____	_____	Hometown At Berea College Other (specify) _____
3.	_____	_____	Hometown At Berea College Other (specify) _____
4.	_____	_____	Hometown At Berea College Other (specify) _____

As a general note, it is never possible to know how answers to a particular survey question might be influenced by respondents' perceptions about how the question will be used. However, in this respect, it is worth noting that this question, which does not refer to race in any way, was embedded in a very substantial survey with an obvious focus on academic performance and educational attainment. Regardless, if such anticipation did occur and if students tend to answer questions in a politically correct manner, then the descriptive statistics discussed in the remainder of this section would understate the degree of sorting that is present, in which case our subsequent results would be strengthened further.

The number of observations for which friendship information is observed (354) is slightly

smaller than the total sample size (375) because two students indicated that they had no friends and nineteen students listed no friends that could be matched with individuals in our student data base. The latter arises primarily because, at the time of our baseline survey, students had been at Berea for a short time and some individuals did not know both the first and last names of some of their friends. Nonetheless, students were reasonably knowledgeable about the names of their friends even at this early point in their college careers; we were able to find approximately 75% of the listed friends in our official database. Not surprisingly, the proportion of friends we were able to match increased dramatically (to approximately 95%) in surveys subsequent to the baseline survey.

Table 2 shows that a very significant amount of sorting by race is present at the start of classes when we characterize sorting using the person that is listed as the best friend in Question A. Pooling males and females and computing sample proportions, the first column shows that 69.6% of black students in our sample have best friends who are black while only 5.7% of white students in our sample have best friends who are black. If sorting were purely random, then, in large samples, the proportion of black students who have black best friends would be 15.8% and the proportion of white students who have black best friends would also be 15.8%. Statistical tests overwhelmingly reject the former hypothesis, the latter hypothesis, and the hypothesis that the two conditions are jointly true.[5,6] The first column of Table 3 shows similar results at the start of classes when we characterize sorting using information about all individuals that are listed as friends in Question A. Pooling males and females we find that, on average, 66.8% of the friends listed by a black student are black while only 9.8% of the friends listed by a white student are black.

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[5]The test of the null hypothesis that the proportion of black students who have black best friends is 15.8% has a standard normal test statistic of 11.334. The test of the null hypothesis that the proportion of white students who have black best friends is 15.8% has a standard normal test statistic of 4.778. A test that the proportion of black students who have black best friends is the same as the proportion of white students who have black best friends has a standard normal test statistic of 12.030.

[6]Sixty percent of male black students in the sample have black best friends while 77% of female black students in the sample have black best friends. Given that this difference is not statistically significant at traditional levels, we do not pay specific attention to differences by sex in the remainder of the paper, although we do find statistically different sorting patterns by sex at some points after the first year.

As will become clear at the end of this section, it is of interest to know whether there exists evidence that a substantial amount of the sorting in the first columns of Tables 2 and 3 arises because individuals make friendship decisions on the basis of other variables that are strongly correlated with race. The second column of Table 2 again examines the proportion of students who have a black best friend, but uses a linear probability model, with whether a person's best friend is black as the dependent variable, to control for a variety of other characteristics that we are able to observe and could be correlated with race. The second column of Table 3 again examines the proportion of a student's friends who are black, but uses a regression model, with the proportion of a student's friends that are black as the dependent variable, to control for the same set of characteristics. In both Table 2 and Table 3, the entries related to the WHITE and BLACK variables remain virtually unchanged when the additional characteristics are added.

3.2   Explaining Sorting

We now propose a model of friendship-making under uncertainty with the goal of inferring beliefs about interracial friendship compatibility at the time of college entrance from the sorting observed in Subsection 3.1. Given that the ultimate goal is to compare these beliefs to what we discover about actual interracial friendship compatibility from the roommate natural experiment discussed in Section 4, we find it useful to phrase the question of interest in this subsection as follows: "for what values of actual interracial friendship compatibility does the model predict that the observed racial sorting would only be possible if some students are incorrectly pessimistic about interracial friendship compatibility?"

We note that while providing an understanding of how beliefs at the time of college entrance are formed is of obvious importance, this is outside the scope of this paper. As a result, this paper has nothing to say, for example, about whether initial beliefs may have been influenced in some way by affirmative action policies.

The conclusion of our model – if true friendship compatibility does not depend on race and if students meet in a random fashion during the freshman orientation period, then

sorting can only be observed if some students have incorrect perceptions about interracial friendship compatibility – is hardly surprising. Nonetheless, the formulation of the model provides a natural framework for discussing the attractiveness of various assumptions and for discussing the robustness of our conclusions to changes in these assumptions.

Payoffs Students in college receive utility from friendships. At any point in time, a student can have at most one (best) friend. The flow utility that student i receives from a friendship with student j is $u_{i,j}$. This utility depends on a variety of characteristics of j. Characteristics of relevance may include, for instance, j's sense of humor and other personality traits, religious and political views, hobbies, interests, and past experiences. The key point is that many of these friendship-relevant characteristics are not easily observable at the time two people initially meet so that i does not know the value of $u_{i,j}$ when she first meets j. In order to simplify the exposition, we take this point to an extreme by assuming that the only characteristic that can be initially observed is a person's race (black or white). We discuss later why our conclusions are not sensitive to this assumption. The payoff to i from a match with j also depends on i's own characteristics but, for ease of exposition, from now on, with the exception of Section 4, we make this implicit in our notation and index payoffs and other relevant variables by j only.

We assume that students do not care about race per se, but may be more likely to find the characteristics that they do care about among students of a particular race. More specifically, we posit that $u_j = v_j$ when j is of the same race as i and $u_j = \mu + v_j$ when j is of the opposite race as i, where μ is a fixed term that can depend only on i's race and the v_j are i.i.d. normal with mean zero and variance σ_v^2 that is the same for all students in college.[7] Hence, for each race the average within-race match quality is higher than the average interracial match quality when $\mu < 0$ and lower when $\mu > 0$. Students do not know

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[7]The assumption of a constant variance can be motivated, in part, by the fact that, as described earlier, students at Berea have similar socio-economic backgrounds. This assumption also means that the variance of friendship quality does not depend on whether person i is considering black or white potential friends. The analysis of this subsection can be modified to accommodate a model where σ_v^2 depends on the identity of a student, but not on the race of his potential friends.

μ and start college with a prior belief about μ that is normally distributed with mean m_μ and variance σ_μ^2, where these quantities need not be the same for all students. The objective in what follows is to compare beliefs about average interracial friendship compatibility, m_μ, with the truth about average interracial friendship compatibility, μ.

Choosing Friends The information from the last columns of the survey question shown in Subsection 3.1 indicates that almost all friendships were formed after students arrived at Berea.[8] Here we describe how students choose friends.

Students arrive at college for an orientation program before classes begin in their freshman year, at the end of which they complete the baseline BPS survey. We assume that each student is assigned to an orientation group with $N > 1$ other students and spends orientation with this group. This orientation group is a somewhat artificial construct which is meant to represent the types of people to which a student is exposed during the orientation period and, therefore, could potentially be chosen as friends.

In terms of formal assignments made by the school, our orientation group construct would capture, for example, the students assigned to one's official orientation group, the students assigned to the same dorm room or dorm floor, and the students assigned to the same job in Berea's mandatory work-study program. Importantly, students are randomly assigned in each of these cases.[9] Our orientation group construct should also reflect the types of students

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[8]We find that 95% of friends were met at Berea. The results in Section 3.1 use all friends, but removing friends who were not met at Berea or removing students who have at least one friend who was not met at Berea leads to virtually no change in the results.

[9]For those that need roommates, the assignment process is unconditionally random (see footnote 16). A housing preference questionnaire is not used at Berea, due to a belief that such questionnaires are of limited usefulness due to misreporting of behaviors such as smoking. Two weeks before the start of school (and after all members of the freshman class have been determined) pairs of roommates were drawn using a random number generator and each pair was randomly assigned to a room on a freshmen dorm floor. As a result, the process ensures randomness with respect to both one's roommate and the students in neighboring rooms. Stinebrickner and Stinebrickner (2004) provide indirect evidence of the randomness in the roommate assignment process by examining the correlation between several observable characteristics of students and their roommates. In addition, in Section 4 we find no evidence of a relationship between a student's race and the race of his assigned roommate. Randomness is also a very reasonable assumption for assignment to work-study jobs (Stinebrickner and Stinebrickner (2003)) and the official orientation group.

that might be encountered through other social avenues during orientation. Randomness also seems a reasonable approximation in this respect. Indeed, Particular clubs that might interest specific types of students do not begin activities during the orientation period and informal events (e.g., parties) held by upperclassmen (which might draw disproportionate numbers of particular types of students) would also be unlikely during this period since school rules imply that almost all students live on campus and upperclassmen are not present on campus during the orientation period.[10] Instead, the primary social events would be general types of functions (e.g., cookouts, etc.) provided by the school that would presumably be of similar interest to all types of students.[11]

Students choose friends in a two-stage process. First, after observing the race of each student in their orientation group, they select a group of $K < N$ individuals with which to interact. For simplicity, we take K to be the same for all students. Then they observe a signal ξ_j of match quality for each person j that is in their selected group and choose an individual of this group with whom to form a friendship.[12,13] The first stage reflects the fact that each student encounters many other students during the orientation period, and so their interaction with some of them will necessarily be superficial, if it happens at all.

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[10]Contributing to the reality that it is very reasonable to assume that off-campus parties represent a neglible portion of social activities during the orientation period is the very low prevalence of alcohol use at Berea (Stinebrickner and Stinebrickner (2007)).

In some schools, one might worry that the assumption of randomness might be violated due to the presence of athletics. However, largely because a football team does not exist, the number of freshmen at Berea who would be on-campus for athletics before/during the orientation period is small. Further, using administrative data we find that athletes at Berea are not disproportionately of any particular race.

[11]In reality, the orientation period consists of two mandatory portions: a summer weekend and a short period immediately before the beginning of courses. We do not make a distinction between these two portions in this section because institutional details suggest that the assumption of randomness of meetings is relevant for both portions. This distinction does have some significance in Section 4, and we discuss it in more detail at that point.

[12]This is a weak view of friendship, where a friend is just someone that a person hangs around with or pays attention to. We do not mean for this assumption to be taken literally, although it would be broadly consistent with the notion that dorms at Berea are rather open places. This assumption is also consistent with the measure of friendship we use in Subsection 3.1.

[13]We are implicitly assuming that a student always finds it desirable to form a friendship at the beginning of college. This corresponds to the extreme case where the value of not forming a friendship is $-\infty$. None of our conclusions depend on this particular assumption.

We note that we implicitly take a rather broad view of friendship compatibility. For example, if a student ends up with a disproportionate number of individuals of the same race in her subgroup because she believes that commonality in background experiences makes it easier to "break the ice" with individuals of the same race, then we interpret this as evidence that the student believes she is more compatible with students of her own race. Likewise, if a student believes it is more costly for her to initiate a friendship with someone of the opposite race, then we also interpret this as evidence that the student believes she is more compatible with students of her own race. In other words, for our purposes, compatibility means both having enough in common to be able to start a conversation and having the desire to continue the relationship.

Finally, we assume that students are myopic. We argue at the end of this section that relaxing this assumption, which is made for convenience, would strengthen our results.

Sorting We do not know how informative are the signals ξ_j that a student observes in her chosen subgroup. This is in part because we do not know exactly how students allocate their time during the couple of days of the orientation period before they complete our baseline survey. In what follows we consider two alternatives that are amenable to a transparent analysis.

We first consider the case where the signals ξ_j provide little information about payoffs. This, in essence, corresponds to the situation in which, during the orientation period, students are very busy registering for courses or performing other tasks in preparation for the start of courses so that they have little time to learn much more than the names of the people they have chosen for their subgroup. In this case, the only thing that matters for a student when selecting a subgroup is the expected payoff of forming a friendship with each individual in her orientation group. In particular, if a student has $m_\mu = 0$, then she is indifferent between all the possible subgroups she can select and, once a subgroup is chosen, she is indifferent between all the individuals in her selected subgroup. Assuming that a student randomizes when indifferent, we have the following result.

Proposition 1. *Suppose signals are not informative. Then, racial sorting can only be observed if some students have $m_\mu < 0$ at the time they enter college. Therefore, if $\mu = 0$ some students will be incorrectly pessimistic about the value of interracial friendship compatibility.*

We now consider the polar case where the signals ξ_j are very informative. This corresponds to the situation where each student spends much quality time with the students in her selected subgroup and, as a result, is able to observe the payoff of forming a match with each of the individuals in this subgroup; i.e., $\xi_j = u_j$. The decision of which friendship to make once a subgroup is chosen is then straightforward: choose a member of the subgroup for which the friendship payoff is the highest. What is left to determine is how students select their subgroups.

For this, notice that if individual j in student i's orientation group is of the same race, then i's perception is that $u_j \sim N(0, \sigma_v^2)$, while if j is of the opposite race, then i's perception is that $u_j \sim N(m_\mu, \sigma_o^2)$, where $\sigma_o^2 = \sigma_\mu^2 + \sigma_v^2$. Hence, if $m_\mu = 0$, then the distribution of possible payoffs from interracial friendships has the same mean, but fatter tails. Now notice that a student only cares about the highest friendship payoff in her selected subgroup. Hence, if she believes that the average friendship payoff is the same for both races, then the greater the number of individuals of the opposite race that she selects, the greater is the chance that one of the people in her subgroup will turn out to be a very good match. Increasing the prior mean only reinforces the bias towards opposite race matches. More importantly, since expected payoffs are continuous in m_μ, this bias persists if m_μ is not too negative. We then have the following result. Its proof and the proof of Proposition 2 below are in the Appendix.

Lemma 1. *There is $\underline{m} < 0$ such that if a student's prior mean is greater than $\underline{m}$, then it is optimal for her to select a subgroup with as many individuals of the opposite race as possible no matter the racial composition of her orientation group.*

Now observe if $\mu = 0$ for a student, so that there is no true difference in the distribution of friendship payoffs across races for her, then all individuals in her selected subgroup are

equally likely to be chosen as a friend. The following result, Proposition 2, follows from this observation. Together with Proposition 1 they constitute the two main results of our model.

Proposition 2. *Suppose that signals are sufficiently informative. If $\mu = 0$ for both races, then racial sorting can only be observed if some students enter college with $m_\mu < 0$, that is, if some students enter college incorrectly pessimistic about the value of interracial friendship compatibility.*

We show in the Appendix that the conclusion of Proposition 2 remains the same if instead of being equal to zero for both races, μ is close to zero for both races.

3.3 Discussion

We end this section with a discussion of some of our modeling choices. We assume that friendship decisions are myopic. Since students believe it is possible that interracial matches are better than same-race ones, choosing someone of the opposite race to interact with provides valuable information for future friendship decisions. Hence, if a student is forward looking when choosing friends, she may be willing to sacrifice some of her payoffs during the orientation period and include more students of the opposite race in her subgroup than she would if she were myopic. This means that Propositions 1 and 2 not only do not depend on the assumption of myopic behavior, but the restrictions on m_μ and μ necessary to generate racial sorting are less stringent if students are forward looking.

We also make the simplifying assumption that friendship decisions are unilateral. This is not a realistic assumption, but, if anything, it makes it more difficult for racial sorting to take place. Indeed, a model where friendship decisions are bilateral should produce stronger conclusions regarding the effect of misperceptions on friendship patterns for the simple reason that for racial sorting to happen it is now only necessary for one side of a potential interracial match to be biased.

Finally, we assume that an individual observes only race when she first meets a potential friend. It is easy to see that our conclusions stay the same if, in addition to race, a person also

observes a set of friendship-relevant characteristics that are uncorrelated with race. Thus, the potentially relevant case is the one where, in addition to race, a person also observes a set of friendship-relevant characteristics that are correlated with race. At the end of Subsection 3.1 we discuss that we are not able to find evidence of these types of characteristics at Berea. Nevertheless, for the sake of illustration, consider the extreme case where the sorting by race in our data is generated because individuals make friendship decisions based on a single observable friendship-relevant characteristic that is strongly correlated with race. In this case, even though the students do not consider race in any way when making friendship decisions, they nevertheless believe that they are more compatible with individuals of the same race (as long as they notice that the characteristic is correlated with race). Thus, for our purposes, this case is no different than our assumed case in which individuals take into account race when making decisions because they believe that race is correlated with unobserved characteristics that are valuable.[14] The open question remains whether or not, in reality, students are more compatible with students of the same race.

4   Evidence About Interracial Compatibility

Given the observed sorting in the data and given the assumptions of our simple model, Propositions 1 and 2 of Section 3 indicate that some students enter college with a misperception about the true value μ of average interracial friendship compatibility if this value is zero. In this section we provide evidence about whether $\mu = 0$. We note that, in addition to being important for examining whether misperceptions exist, understanding whether black and white students are compatible as friends is of direct interest given that arguments about the benefits of educational diversity are often premised on the notion that students from

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[14]However, the two situations suggest different reasons for why a misperception might exist. In the case where decisions are made solely on the basis of an observed friendship characteristic that is correlated with race, misperceptions would have to arise because the characteristic is not as important for friendship quality as one expected. In the case where a person takes into account race when making decisions because she believes that race is correlated with unobserved characteristics that are valuable, misperceptions arise if the student is wrong about how race is correlated with these other unobserved characteristics.

different races have much in common.

To provide evidence about whether $\mu = 0$, we take advantage of the fact that students are assigned roommates in an entirely random manner which, for example, does not take into account any characteristics or preferences of students. To the extent that sharing a room makes a non-trivial amount of interaction and observation unavoidable, this implies that some students are, in essence, forced to learn about their match quality with one randomly chosen roommate of the same race while other students are, in essence, forced to learn about their match quality with one randomly chosen roommate of a different race.

It is plausible to assume that by some time T sufficiently late in the first academic year each student i has learned the payoff $u_{i,R}$ of a friendship with her assigned roommate R. Then, comparing the average value of $u_{i,R}$ for roommate pairs where $\text{Race}_i = \text{Race}_R$ to the average value of $u_{i,R}$ for roommate pairs where $\text{Race}_i \neq \text{Race}_R$ would provide direct evidence about whether $\mu = 0$. In reality, we do not observe match quality directly, but we do observe whether a roommate eventually becomes a best friend. For the exercise here it is not necessary to describe how friendship decisions evolve over time between the beginning of the year and T. Rather, it is sufficient to note that at T this process would produce a best non-roommate friend B. For simplicity, we assume that there is no uncertainty about $u_{i,B}$ at T. Then information about whether roommates are best friends at T yields an estimate of $\Pr(u_{i,R} > u_{i,B})$ for roommate pairs where $\text{Race}_i = \text{Race}_R$ and an estimate of $\Pr(u_{i,R} > u_{i,B})$ for roommate pairs where $\text{Race}_i \neq \text{Race}_R$. We reject the null hypothesis that individuals are, on average, equally compatible with students of the same race (i.e., the null hypothesis that $\mu = 0$) if these estimates allow us to reject the null hypothesis that $\Pr(u_{i,R} > u_{i,B})$ is the same for roommate pairs where $\text{Race}_i = \text{Race}_R$ as it is for roommate pairs where $\text{Race}_i \neq \text{Race}_R$.[15] Similarly, we can also gain information about μ by examining whether a roommate becomes one of a person's four friends. In this case, the inference concerns whether

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[15]An implicit assumption is that the expected value of $u_{i,B}$ does not depend on whether a person's roommate is of the same race or a different race. The conclusion that we learn specifically about μ by comparing $\Pr(u_{i,R} > u_{i,B})$ across same race and different race roommate pairs comes from our assumption that the variance of match quality does not depend on the race of one's potential friend.

$\Pr(u_{i,R} > u_{i,B4})$ is the same for roommate pairs $\text{Race}_i = \text{Race}_R$ as it is for roommate pairs where $\text{Race}_i \neq \text{Race}_R$, where $B4$ denotes the fourth best non-roommate friend.

Specifically, we take advantage of the fact that we collected friendship data at multiple times each year and define our T to correspond with the friendship survey that was collected at the end of the first semester. For the 2001 cohort we have 27 white students in our initial sample who were identified as having been randomly assigned black roommates and 155 white students who were identified as having been randomly assigned white roommates.[16] For this cohort we find that that 44.4% of black roommates are listed as one of the four friends, 35.4% of white roommates are listed as one of the four friends, 18.5% of black roommates become best friends, and 18.7% of white roommates become best friends.[17] Combining the 2000 and 2001 cohorts to increase the number of observations, we have 60 white students who were identified as having been randomly assigned black roommates and 321 white students who were identified as having been randomly assigned white roommates. For the combined cohorts we find that 35.0% of black roommates are listed as one of the four friends, 36.7% of white roommates are listed as one of the four friends, 16.7% of black roommates become best

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[16]The reality that, as described in footnote 9, the orientation period consists of two portions is the primary reason that the number of observations in this section is smaller than that in Table 2 – 30% of students request a roommate that they have met in the first (summer) portion. Although we are not able to use these 30% of the observations in this section, we stress that they are not problematic for the analysis in Section 3 because they simply represent friendship decisions that came out of a random meeting process in the summer portion of the orientation period. Of the 298 white students in Column 1 of Table 2, 24 were assigned a single room, lived off-campus, or we could either not determine whom the student's roommate was or whether the student requested a roommate. Of the remaining 274 students, 193 were randomly assigned roommates (155 white, 27 black, 11 race missing - not used). Of the 56 black students in Column 1 of Table 2, 5 students were assigned a single room, lived off-campus, or we could either not determine whom the student's roommate was or whether the student requested a roommate. Of the remaining 51 students, 32 were randomly assigned roommates (28 white, 3 black, 1 race missing - not used). Students who choose roommates themselves during the first orientation period may be different than those that do not. However, we find that the degree of sorting as represented by the two rows of Table 2 are very similar for the two groups; the two proportions for the randomly assigned group are .718 and .086 (versus .696 and .057) and the three tests described earlier in footnote 5 continue to be overwhelmingly rejected with standard normal test statistics of 11.047, 4.314, and 8.715, respectively. We note that, technically speaking, our conclusions about whether misperceptions exist at the time of entrance are directly relevant for the group of students who are randomly assigned roommates.

[17]The standard errors associated with the proportions are .095, .038, .074, and .021 respectively.

friends, and 16.5% of white roommates become best friends.[18] Thus, because the sample proportions are always close for black and white roommates and are often higher for black roommates, we are never close to rejecting the null hypothesis that white students are equally compatible with black students as they are with white students. That is, consistent with the notion that black and white students do have a lot in common, we find evidence in support of the null hypothesis that $\mu = 0$ for white students.

It is not possible to provide much information about the compatibility of black students with other black students since the random assignment implies that only a very small fraction of all matches would involve two black students.[19] However, we can examine whether black students in the interracial pairs have views about their interracial roommates that are similar to those held by the white students in the interracial pairs. We find that this is the case. For the 2001 cohort we have 28 black students in our initial sample who were identified as having been randomly assigned white roommates. We find that 39.3% of these roommates are listed as one of the four friends (compared to 44.4% for white students in interracial pairs) and that 17.9% of these students become best friends (compared to 18.5% for white students in interracial pairs).[20] Combining the 2000 and 2001 cohorts, we have 60 black students who were identified as having been randomly assigned white roommates. We find that 35.0% of these roommates are listed as one of a the four friends (compared to 35.0% for white students in interracial pairs) and that 18.3% of these students become best friends (compared to 16.7% for white students in interracial pairs).[21] Thus, again consistent with the notion that black and white students have a lot in common, it seems reasonable to conclude that there is evidence in support of the null hypothesis that $\mu = 0$ for black students. This would be true, for example, if the compatibility of black students with other black students is roughly the same as the compatibility of white students with other white students.

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[18]The standard errors associated with the proportions are .061, .026, .020, and .048 respectively.

[19]From footnote 16 we see that 14.2% of the students who were randomly assigned roommates are black so that roughly $(.142)^2 = .002$ of all matches would involve two black students. In the sample we find that .014 of all matches for which the race of the roommate can be identified involve two black students.

[20]The standard errors associated with the proportions are .092 and .072 respectively.

[21]The standard errors associated with the proportions are .062 and .048 respectively.

5 Alternative Explanations

While we think that our model captures the fundamental features of the friendship-making process at the time of college entrance, it is worth considering possible changes to the model that might imply that our conclusions about beliefs would be wrong. One possibility is that social norms (stigmas) imply that there is a cost to having both black friends and white friends. For example, if friends of one's own race criticize a student for having friends of a different race, then a person may not choose to have friends of both races even if he thinks that he is equally compatible with students of both races. However, there are a couple of things to note. First, if such a situation does exist, then it is strongly suggestive that at least some people on campus believe that blacks and whites are quite different and probably not particularly compatible – a view that is consistent with our conclusions about beliefs. Second, in such a situation, if, social norms aside, black students were truly indifferent between having black and white friends, our model suggests that they would choose to have only white friends since they are the majority group. Of course, this would not be the case if a black person with white friends is outwardly harassed on campus by black non-friends, but this is a view of things that seems very inconsistent with the environment at Berea. Thus, at least at Berea, this social norm view of things does not seem particularly satisfying.[22]

Another possibility would be that both white and black students correctly believe that they are equally compatible with students of the other race, but at least one group believes that the other is biased. Thus, racial sorting would occur because students do not try friendships with individuals of the other race for fear of not being reciprocrated. This is a somewhat different view of the data, but the conclusion for policy is essentially the same: there is something to be learned at school.[23]

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[22]A variant of this explanation would be that social stigmas are present because of the the views of parents. For example, a student who believes that she is equally compatible with students of all races might end up with more friends of the same race if it is unpleasant to introduce a friend of a different race to her family.

[23]In order to evaluate this possibility we need a measure of friendship that is different from the one of Subsection 3.1. Now two students are friends only if they nominate each other; that is, only if there is reciprocity.

A third possibility, raised by Cornell and Welch (1996) in a labor market context, would be that students believe they are equally compatible with students of all races, but they are worse at evaluating their friendship compatibility with a person of a different race, making it more likely that students become friends with other students of the same race.

6 Direct Evidence About Beliefs

Sections 3 and 4 strongly suggest that some students (black or white or both) believe that, on average, they are more compatible with students of the same race than with students of other races at the time of college entrance. However, because, as illustrated by Section 5, it would never be possible to rule out with certainty all conceivable explanations for the observed sorting, it is desirable to provide direct evidence about this conclusion. An additional benefit of providing direct evidence is that, unlike the previous analysis, it potentially allows us to provide evidence about whether sorting is being generated by the preferences of white students, black students, or both.

The obvious difficulty in providing direct evidence about beliefs is that it is easy to imagine a variety of reasons why a person may consciously or subconsciously provide a biased view of her beliefs about interracial friendship compatibility if directly asked about this issue. We take a survey approach which utilizes the random assignment of roommates to circumvent this problem. In 2005, at the beginning of classes, a recent cohort of Berea College Freshmen answered the following question:[24]

Question B. The relationship students have with their roommates can possibly have an important effect on students' experiences during school. The following question is motivated by our interest in this issue.

If you were to ignore all outside pressures related to making friends, which of the following best describes your belief when you first saw your roommate before you got much of a chance to talk to

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[24]All evidence suggests that the sample here and the sample used in the remainder of the paper can be viewed as being drawn from the same population. For example, there was no observable change in the admissions procedures/outcomes or the environment at Berea between 2001 and 2005.

him/her or get to know him/her? Circle ONE

A. I thought it was very likely that this person would be a good match for me as a friend.

B. I thought it was somewhat likely that this person would be a good match for me as a friend.

C. I thought it was somewhat unlikely that this person would be a good match for me as a friend.

D. I thought it was very unlikely that this person would be a good match for me as a friend.

The appeal of this survey question is that the issue of race is not mentioned in an explicit way.[25] However, we could never rule out the possibility that some students anticipate that Question B will be used to examine issues related to race. In this case, a tendency towards political correctness would produce answers that tend to overstate enthusiasm about students from different races. As such, a result that a particular group is more pessimistic about students from a different race could reasonably be viewed as evidence that that this group believes that, on average, they are more compatible with students of the same race. However, to be appropriately cautious, no conclusions should be drawn about true beliefs if the results indicate a lack of evidence that a particular group is more pessimistic about students from a different race. Related to this, it seems possible that the tendency towards political correctness may differ by race.[26]

Table 4 shows the results separately by race. A comparison of the first two columns allows us to examine whether white students believe that they are more compatible with other white students than black students. We find no evidence that this is the case; the sample proportion of white students who believed that their white roommate was very likely

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[25]By asking students to "ignore all outside pressures" we hope to remove any possible consideration of social stigmas in their responses.

[26]Clearly there would be little value in our question if students had directly chosen their own roommates. Even if this is not the case, the value of our question would depend on what was observed at the time a person "first saw her roommate" if administrators used, for example, a housing preference questionnaire. If all that is observed when students first see each other is race, then it would not make a difference if students were matched by administrators on the basis of a characteristic such as smoking behavior. However, if, in this example, smoking behavior is observable (and valued) when two roommates first see each other, then one would expect views in a case where an administrator tries to achieve compatibility to be different than the unconditional views. Thus, it is beneficial that, with the unconditional random assignment, the question allows us to document the unconditional distribution of views that a particular racial group has (at the time of initial meetings) about compatibility with individuals of the same race and the opposite race.

to be a good match is smaller than the sample proportion of white students who believed that their black roommate was very likely to be a good match (24.6% versus 34.4%). Thus, the previous discussion suggests that, if we wish to be somewhat cautious, we should perhaps draw no conclusions from this finding.

However, we do find evidence in Table 4 that black students are not nearly as optimistic about interracial compatibility as white students. While 34.4% of white students believed that their randomly assigned black roommate was very likely to be a good match, only 9.70% of black students (in the same pairs) believed that their randomly assigned white roommate was very likely to be a good match. A test of the null hypothesis that white students are equally likely as black students to believe that a roommate of a different race is very likely to be a good match is rejected at all levels of significance greater than .018.

It is not possible for us to observe how positive black students are about their compatibility with other black students since random assignment implies the data contain only a very small number of black-black roommate pairs. However, under the assumption that black students are (at least) as optimistic about their compatibility with other black students as white students are about their compatibility with black students, the test above implies that we would reject the null hypothesis that black students believe that they are as compatible with white students as they are with black students. While this assumption seems natural, it seems worthwhile to provide some evidence that it is likely to be true. If it were not true, then black students would be more pessimistic about their compatibility with all types of students.[27] Given that the quality of one's personal relationships undoubtedly plays a very central role in how enjoyable it is to be in school, black students should then appear more pessimistic on the following survey question which appeared on the baseline survey:

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[27]One might generally worry that this might be the case for black students because these students are more likely to be first generation college students. However, given that the mission of Berea College involves educating students from low income families, black and white students at this school tend to come from fairly homogenous family backgrounds.

Question C. Circle the one answer that best describes your beliefs at this time. Circle ONE

A. I believe that being in college at Berea will be much more enjoyable than not being in college.

B. I believe that being in college at Berea will be somewhat more enjoyable than not being in college

C. I believe that I will enjoy being in college at Berea about the same amount as I would enjoy not being in college.

D. I believe that being in college at Berea will be somewhat less enjoyable than not being in college.

E. I believe that being in college at Berea will be much less enjoyable than not being in college

For the sample in the first column of Table 2, the results in Table 5 provide evidence that is strongly inconsistent with the notion that black students are fundamentally more pessimistic than white students. For example, the percentage of black students in the sample who believe that "being in college at Berea will be much more enjoyable than not being in college" is higher than the percentage of white students in the sample that believe this to be true (80% versus 68%). Further, we can reject the null hypothesis that the population percentages are equal at a significance level of .05 so that, if anything, black students may be more optimistic than white students. None of the 55 black students believe that being in school will be less enjoyable than being out of school. As a result, it seems reasonable to view the results from Question B as some evidence that black students believe that, on average, they are more compatible with students of the same race. Thus, while typically not the focus of policy discussion, the results suggest that the minority group may have incorrect beliefs at the time of entrance. As discussed before, we do not feel comfortable concluding anything about the beliefs of the majority group from this direct question.

7   Conclusion

We find evidence that students from different races are very compatible as friends at Berea College and that some students enter college with a misperception about this compatibility.

It seems quite possible that students who select Berea are more informed about interracial compatibility than students elsewhere. This alone would suggest that our finding that a misperception exists at Berea would imply that misperceptions also exist elsewhere.[28] However, we feel that it is important to be cautious about this conclusion since, among other things, it is possible that the true value of interracial friendship compatibility may be different elsewhere. Nonetheless, we believe that the paper makes an important contribution of direct relevance for the primary legal argument in support of affirmative action admission policies by establishing that there do indeed exist situations where students from different races have a lot in common but do not fully realize that this is the case. The spirit of studying one school in order to take advantage of unique data and knowledge of institutional details is consistent with other related literature such as Boisjoly et. al. (2006) and Marmaros and Sacerdote (2006).

This paper examines one fundamental condition that is necessary for the primary legal argument in support of affirmative action admission policies to be compelling, that misperceptions do exist. We stress that our results do not provide any evidence about the second necessary condition described in the introduction, that diversity is effective in alleviating misperceptions. We do collect friendship information after the first year. However, we do not think that this information is sufficient to provide credible information about whether misperceptions might be alleviated through diversity; even if beliefs about friendship compatibility change over time, substantial sorting may persist because either friendships made at the beginning of school tend to be permanent in nature or because initial friendship decisions play an important role in determining the network through which a person meets potential friends after the beginning of classes. Thus, we feel most comfortable leaving the examination of the second necessary condition to the work of others.

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[28]In particular, this might suggest that our finding that the minority group at Berea is incorrectly pessimistic about interracial friendship compatibility might be strengthened elsewhere, but might also suggest that our finding that the majority group at Berea is correctly optimistic about interracial friendship compatibility might not be true elsewhere.

References

[1] Arcidiacono, Peter, Shakeeb Khan, and Jacob Vigdor, "Representation versus assimilation: How do preferences in college admissions affect social interactions," working paper, 2006.

[2] Alger, Jonathan, "The Educational Value of Diversity," Academe: Bulletin of the AAUP, Vol. 83, No. 1, (January, February), 1997.

[3] Alger, Jonathan and Eric Albert, "Affirmative Action in Higher Education: A Current Legal Overview," Making the Case for Affirmative Action in Higher Education, American Council of Education, (1999).

[4] Baez, Benjamin, "Affirmative Action, Diversity, and the Politics of Representation in Higher Education," The Journal of Higher Education 74.1 (2003) 96-107.

[5] Boisjoly, Johanne, Greg Duncan, Michael Kremer, Dan Levy, and Jacque Eccles, "Empathy or antipathy? The impact of Diversity," American Economic Review, 96(5), 2006, 1890-1905.

[6] Cornell, Brad and Ivo Welch, "Culture, Information and Screening Discrimination," Journal of Political Economy, 104 (1996), 542-571.

[7] Charles, Kerwin, Erik Hurst, and Melvin Stephens, "Exploring Racial Differences in Vehicle Loan Rates," working paper, 2006.

[8] Elgass, Jane R. "Best Affirmative Action Defense is Need for Diverse Environment," The University of Michigan Record, December 7, 1998.

[9] Fryer, Roland, and Paul Torelli, "An Empirical Analysis of Acting White," Working paper, (2006).

[10] Gratz et al. v. Bollinger et al., Syllabus, Supreme Court of the United States, No. 02-516 (2003).

[11] Marmaros, David, and Bruce Sacerdote, "How Do Friendships Form?" The Quarterly Journal of Economics, February (2006), 79-119.

[12] Mayer, Adalbert, and Steven Puller, "The Old Boy (and Girl) Network: Social Network Formation on University Campuses," Working paper, Texas A&M University, December, 2006.

[13] Stinebrickner, Todd, and Ralph Stinebrickner, "Time-use and college outcomes," Journal of Econometrics, 121 (2004), 243-269.

[14] Stinebrickner, Todd, and Ralph Stinebrickner, "Working during school and academic performance," Journal of Labor Economics, 21(2) (2003), 473-491.

[15] Stinebrickner, Todd, and Ralph Stinebrickner, "What can be learned about peer effects using college roommates? Evidence from new survey data and students from disadvantaged backgrounds," Journal of Public Economics, 90 (2006), 1435-1454.

[16] Stinebrickner, Todd, and Ralph Stinebrickner, "Credit Constraints and College Attrition." forthcoming, The American Economic Review.

[17] Stinebrickner, Todd, and Ralph Stinebrickner, "The Causal Effect of Studying on Academic Performance, NBER working paper #w13341 (2007).

8 Appendix

Proof of Lemma 1: Suppose that a student's orientation group has $n \geq 1$ individuals of the opposite race and consider a policy that selects a subgroup with r of them. Notice that r is at most $\bar{r}(n) = \min\{n, K\}$. Now observe that conditional on race, all members of a student's orientation group look the same before she selects which subgroup to interact with. Hence, any policy that selects r individuals of the opposite race has the same expected payoff, that we denote by $u(r|n, m_\mu, \sigma_\mu^2)$ since it also depends on a student's prior mean and variance. Let X_{m,σ^2} denote the normal random variable with mean m and variance σ^2. Then, by construction,

$$u(r|n, m_\mu, \sigma_\mu^2) = \int \max\{z_1, \ldots, z_K\} dX_{m_\mu,\sigma_o^2}(z_1) \cdots dX_{m_\mu,\sigma_o^2}(z_r) dX_{0,\sigma_v^2}(z_{r+1}) \cdots dX_{0,\sigma_v^2}(z_K),$$

where we recall that $\sigma_o^2 = \sigma_v^2 + \sigma_\mu^2$.

We now show that there is $\underline{m} < 0$ such that if $m_\mu > \underline{m}$, then $u(r|n, m_\mu, \sigma_\mu^2)$ is strictly increasing in r for all $n \in \{1, \ldots, N\}$. For this observe that: (i) X_{m_1,σ^2} first order stochastically dominates X_{m_2,σ^2} if $m_1 > m_2$; and (ii) X_{m,σ_1^2} second order stochastically dominates X_{m,σ_2^2} if $\sigma_1^2 > \sigma_2^2$. Moreover, $\max\{a, z\}$ is increasing and convex in z for all $a \in \mathbb{R}$. Hence, $m_\mu \geq 0$ implies that

$$u(r|n, m_\mu, \sigma_\mu^2) =$$
$$= \int \max\{z_1, \ldots, z_K\} dX_{m_\mu,\sigma_o^2}(z_1) \cdots dX_{m_\mu,\sigma_o^2}(z_r) dX_{0,\sigma_v^2}(z_{r+1}) \cdots dX_{0,\sigma_v^2}(z_K)$$
$$\geq \int \max\{z_1, \ldots, z_K\} dX_{m_\mu,\sigma_o^2}(z_1) \cdots dX_{m_\mu,\sigma_o^2}(z_{r-1}) dX_{0,\sigma_o^2}(z_r) dX_{0,\sigma_v^2}(z_{r+1}) \cdots dX_{0,\sigma_v^2}(z_K)$$
$$> \int \max\{z_1, \ldots, z_K\} dX_{m_\mu,\sigma_o^2}(z_1) \cdots dX_{m_\mu,\sigma_o^2}(z_{r-1}) dX_{0,\sigma_v^2}(z_r) dX_{0,\sigma_v^2}(z_{r+1}) \cdots dX_{0,\sigma_v^2}(z_K)$$
$$= u(r-1|n, m_\mu, \sigma_\mu^2),$$

where the first inequality follows from (i) and the second inequality follows from (ii) and the fact that $\int \max\{0, z\} dX_{0,\sigma^2} = \sqrt{\sigma/2\pi}$ is strictly increasing in σ. The desired result is then a consequence of the fact that the functions $u(r|n, m_\mu, \sigma_\mu^2)$ are continuous in m_μ. Notice that $\underline{m}$ depends on σ_μ^2. $\square$

Corollary 1. *Suppose that $\mu = 0$ for a student. There is $\underline{m} < 0$ such that if this student is black (white) and has $m_\mu > \underline{m}$, then the probability that she has a black friend at the end of the orientation period is less (more) than the fraction of black students in college.*

Proof: Let $\pi(\omega, r|\mu)$ be the probability, as a function of μ, that a student of race ω chooses a black student as a friend when the subgroup she selects has r such students. It is well-known that if Z_1 to Z_n are independent draws from the same real-valued random variable Z, then $\Pr[\max\{Z_1, \ldots, Z_r\} \geq \max\{Z_{r+1}, \ldots, Z_n\}] = r/n$ if Z has no mass points. Hence, $\pi(\omega, r|0) = r/K$. Now let b be the fraction of black students in college and let $\Pi(\omega, m_\mu, \sigma_\mu^2|\mu)$ be the probability, as a function of μ, that during the orientation period a student of race ω, prior mean m_μ, and prior variance σ_μ^2 chooses a black student as a friend. By Lemma 1, there exists $\underline{m} = \underline{m}(\sigma_\mu^2) < 0$ such that if $m_\mu > \underline{m}$, then

$$\Pi(\text{white}, m_\mu, \sigma_\mu^2|0) = \sum_{n=0}^{N} \binom{N}{n} b^n (1-b)^{N-n} \pi(\text{white}, \overline{r}(n)|0) > \frac{1}{K} \sum_{n=0}^{N} \binom{N}{n} n b^n (1-b)^{N-n} > b,$$

where the first inequality follows from the assumption that $K < N$. Recall that $\overline{r}(n) = \min\{n, K\}$ is the maximum number of individuals of the opposite race that a student can select when her orientation has n such students. Similarly, $m_\mu > \underline{m}$ implies that

$$\Pi(\text{black}, m_\mu, \sigma_\mu^2|0) = \sum_{n=0}^{N} \binom{N}{n} (1-b)^n b^{N-n} \pi(\text{black}, K - \overline{r}(n)|0) < b.$$

$\square$

Proof of Proposition 2: Proposition 2 follows immediately from Corollary 1. $\square$

Note that Proposition 2 also holds for values of μ that are close to zero. This follows from the fact that the probabilities $\pi(\omega, r|\mu)$ are continuous in μ, and so are the probabilities $\Pi(\omega, m_\mu, \sigma_\mu^2|\mu)$. Indeed, let $m^* < 0$ be the maximum among all students in college of the cutoff $\underline{m}$ given by Lemma 1.[29] Then, $m_\mu > m^*$ implies that $\lim_{\mu \to 0} \Pi(\text{white}, m_\mu, \sigma_\mu|\mu) > b$ and $\lim_{\mu \to 0} \Pi(\text{black}, m_\mu, \sigma_\mu|\mu) < b$. Hence, for $\mu > m^*$ and close to zero, we can only observe

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[29]Notice that $\underline{m}$ also depends on σ_v^2. Hence, if students were to differ in σ_v^2 there would be no change in the proof of Proposition 2 other than that the value of m^* would be different.

racial sorting at the end of the orientation period if a large number of students enters college with a prior mean lower than m^*, and so lower than μ^*.